

DRAFT

Modular Concrete Bunker Indirect Fire Validation



***Fort Polk, LA
August 4th to 13th, 2004***

DRAFT Series 1 - ***Buried Emplacement***



- 4' soil cover - sandy clay
- Experimental objectives:
 - ✓ Evaluate constructability
 - ✓ Evaluate structural response to blast effects of 122mm rocket/155mm artillery



DRAFT Series 1 - Buried Emplacement

Shot 1-1

- 12 lb C4 to simulate M107, 155mm artillery or 9M22Y, 122mm rocket
- Charge placed top-center of 6" walled barrel



- No effect on concrete section
- Crater dimensions:
 - ✓ diameter = 7'-8"
 - ✓ depth = 2'-2"



DRAFT Series 1 - Buried Emplacement

Shot 1-2



- 12 lb C4 to simulate M107, 155mm artillery or 9M22Y, 122mm rocket
- Charge placed 3'-6" to side of 6" walled barrel

- No effect on concrete section
- Crater dimensions:
 - ✓ diameter = 7'-11"



DRAFT Series 1 - ***Buried Emplacement***



External Video



Shot 1-2

Internal Video



DRAFT Series 1 - Buried Emplacement



Shot 1-3

- 12 lb C4 to simulate M107, 155mm artillery or 9M22Y, 122mm rocket
- Charge placed top-center of entrance section



- No effect on concrete section
- Overturned Hesco retaining walls
- Clear egress remained at opposite end

DRAFT Series 1 - ***Buried Emplacement***



External Video



Shot 1-3

Internal Video



DRAFT Series 1 - Buried Emplacement



Shot 1-4

- 20 lb C4 to simulate M795, 155mm artillery
- Charge placed top-center of 9" walled section

- Induced two flexural cracks in roof; crack widths approx. 1/16th inch
- No measurable permanent deflection in roof
- Crater dimensions:
 - ✓ diameter = 11'-6"



DRAFT Series 1 - ***Buried Emplacement***



External Video



Shot 1-4

Internal Video



DRAFT Series 1 - ***Buried Emplacement***

Results

- Executed four experiments to validate structural response to blast effects of quick-fuzed 155mm artillery and 122mm rocket
- Explosive charge weights include 12 lb C4 and 20 lb C4
- Structure survived blast effects of all charges
- Viable ingress/egress was maintained in all experiments



DRAFT Series 2 - Line-of-Fire Denial



In-theatre

- **Experimental objectives:**

- ✓ **Validate the level of protection increase provided by a modified entrance section which denies fragment line-of-fire**

- **Evaluated two bunkers:**
 - **One recently observed in-theatre with open ends constructed from jersey barriers, and**
 - **One constructed with a modified entrance intended to deny line-of-fire**



Modified Entrance

DRAFT Series 2 - Line-of-Fire Denial



Shot 2-1

- Weapon placed 10' from corner of bunker
- Simulating contact detonation on ground
- Oriented at 10° from normal impact

- Foam/plywood witness panel hit hundreds of times
- Witness panel plywood perforated 52 times
- No hits observed in witness panel within 19" of inside wall



DRAFT Series 2 - Line-of-Fire Denial



Shot 2-2

- Weapon placed 4'-10" above ground, in-line with center of structure
- Simulating proximity fuse
- Oriented at 10° from

- Foam/plywood witness panel hit hundreds of times
- Witness panel plywood perforated 221 times
- No hits observed in witness panel within 14" of ground



DRAFT Series 2 - Line-of-Fire Denial

Shot 2-3

- Weapon placed between jersey barrier and bunker
- Simulating contact detonation on ground
- Oriented at 10° from



- Foam/plywood witness panel destroyed
- Significant damage to inside walls of structure



DRAFT Series 2 - Line-of-Fire Denial



Shot 2-4

- Weapon placed 10' from entrance to bunker
- Simulating contact detonation on ground
- Oriented at 10° from normal and at best line-of-fire into bunker
- Utilized 22 ga. aluminum sheet to man

- Tremendous number of hits on aluminum panel
- Fragment damage to walls in entryway
- Moderate number of hits on witness panel foam (all secondary debris)



ERDC  **No perforation of plywood**
Engineer Research and Development Center

DRAFT Series 2 - Line-of-Fire Denial



Shot 2-5

- **Weapon placed 1' from entrance to bunker**
- **Simulating contact detonation on ground**
- **Oriented at 10° from normal and at best line-of-fire into bunker**
- **No aluminum witness panel**
- **Frag damage to walls in entryway**
- **Numerous hits on witness panel foam (secondary debris & small frags)**
- **No perforation of plywood**

DRAFT Series 2 - Line-of-Fire Denial

Results

- Witness panels placed 2.5' from entrance
- 52 perforations of witness panel plywood in 2-1
- 221 perforations of witness panel plywood in 2-2
- Witness panel destroyed in 2-3
- Moderate fragmentation damage to structure walls and

- Witness panels placed 2.5' from entrance
- Moderate fragmentation damage to entrance walls
- Numerous secondary debris hits on witness panels which penetrated into foam
- No perforation of plywood



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Series 3 - Aboveground Emplacement

- **Experimental objectives:**
 - ✓ **Validate response of bunker to fragmentation and blast effects of various weapons**
- **Weapons considered are:**
 - ✓ **Yugoslavian 82mm mortar**
 - ✓ **Yugoslavian 120mm mortar, M62P3**
 - ✓ **Russian 122mm rocket, 9M22Y**



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Series 3 - Aboveground Emplacement

Shot 3-1

- 82mm mortar
- Placed top-center of entrance section
- Direct contact with roof
- Oriented at 55° from normal impact



- No fragment penetration into structure
- Minor shockwave induced back-face spall
- No perforation of witness panel plywood



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Series 3 - Aboveground Emplacement



External Video



Shot 3-1

Internal Video



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Series 3 - Aboveground Emplacement

Shot 3-2



- 120mm mortar
- Placed top-center of 6" barrel
- 2 layers of sandbags placed on roof (approx. 8" total thickness)
- Oriented at 55° from



- No fragment penetration into structure
- Flexural roof response to blast loading
- Approx. permanent deformation

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Series 3 - Aboveground Emplacement



External Video



Shot 3-2

Internal Video



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Series 3 - Aboveground Emplacement

Shot 3-3



- No fragment penetration into structure
- Significant flexural roof response to blast loading
- Approx. permanent deformation = 6"-8"
- Back-face spall due to shock and flexural deformation

- 122mm rocket
- Placed top-center of 6" barrel
- 4 layers of sandbags placed on roof (approx. 20" total thickness)
- Oriented at 55° from



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Series 3 - Aboveground Emplacement



External Video



Shot 3-3

Internal Video



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Series 3 - Aboveground Emplacement

Shot 3-4



- Minor fragment penetration into structure
- Moderate shockwave induced back-face spall
- Approx. 4"x19" breach
- Numerous penetrations into witness panel foam (secondary debris)



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ERDC Experimental Team

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